CRYOBIOLOGY

International Journal of Low Temperature Biology and Medicine

EDITOR-IN-CHIEF: Arthur W. Rowe

CORRESPONDING EDITORS

Rene Agid
Toulouse, France

E. Asahina
Sapporo, Japan

H. W. Krijnen
Amsterdam, The Netherlands

David E. Pegg
Harrow, England

EDITORIAL BOARD

Michael J. Ashwood-Smith
Donald L. Ballantyne
John F. Brandts
Arthur B. Callahan
Louis S. Diamond
Owen R. Fennema
Frank Gollan
R. I. N. Greaves
Donald Greiff
Charles E. Huggins
L. Jansky
Gerald A. Jung
W. Larcher
Alan P. MacKenzie
Theodore I. Malinin
Peter Mazur
Joseph L. Melnick
Harold T. Meryman
Yoshimasa Nishikawa
J. A. Panuska
Vojin P. Popovic
Louis Rey
Sidney Shulman
Denise Simatos
David Siminovitch
Frank E. South
John S. Willis

ACADEMIC PRESS
New York and London

A Subsidiary of Harcourt Brace Jovanovich, Publishers

Volume 12, 1975

Copyright © 1975 by Academic Press, Inc.

All rights reserved

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the copyright owner.

Contents of Volume 12

Number 1, February 1975

Donald Greiff, Hewlett Melton, and Terrence W. G. Rowe. On the Sealing of Gas-Filled Glass Ampoules 1

E. Israeli, A. Kohn, and Janina Gitelman. The Molecular Nature of Damage by Oxygen to Freeze-Dried *Escherichia coli* 15

M. J. Ruwart, J. F. Holland, and A. Haug. Fluorimetric Evidence of Interactions Involving Cryoprotectants and Biomolecules 26

G. Ali Mansoori. Kinetics of Water Loss from Cells at Subzero Centigrade Temperatures 34

G. E. P. M. Van Venrooij, A. M. H. J. Aertsen, W. M. A. Hax, P. H. J. T. Ververgaert, J. J. Verhoeven, and H. A. Van Der Vorst. Freeze-Etching: Freezing Velocity and Crystal Size at Different Locations in Samples 46

M. Krasnuk, G. A. Jung, and F. H. Witham. Electrophoretic Studies of the Relationship of Peroxidases, Polyphenol Oxidase, and Indoleacetic Acid Oxidase to Cold Tolerance of Alfalfa 62

J. Nath and J. O. Anderson. Effect of Freezing and Freeze-Drying on the Viability and Storage of *Lillium longiflorum* L. and *Zea mays* L. Pollen 81

Brief Communications

F. D. Westfall and G. C. Harris, Jr. The Ability of Cryopreservatives to Prevent Motility Loss and Freeze-Thaw Damage to the Acrosome of Chicken Spermatozoa 89

R. L. Ax and J. R. Lodge. Rooster Spermatozoan Motility, Forward Progression, and Fertility after Storage at 25, 5, or −196°C in Various Extenders 93

W. J. Weaver, F. S. Weber, M. G. Reiney, and S. W. Jacob. An Audio Frequency Magnetic Tape Programmer for Cryopreservation Equipment 98

Number 2, April 1975

C. A. Walter, Stella C. Knight, and J. Farrant. Ultrastructural Appearance of Freeze-Substituted Lymphocytes Frozen by Interrupting Rapid Cooling with a Period at −26°C 103

Fabian J. Lionetti and Stephen M. Hunt. Cryopreservation of Human Red Cells in Liquid Nitrogen with Hydroxyethyl Starch 110

L. Weatherbee, E. D. Allen, H. H. Spencer, S. M. Lindenauer, and P. A. Permoad. The Effect of Plasma on Hydroxyethyl Starch-Preserved Red Cells 119

I. A. Jacobsen, E. Kemp, and H. Starklint. Glycerol used as a Cryoprotectant in Subzero Preservation of Rabbit Kidneys 123

Armand M. Karow, Jr., and Marshal Shlafer. Ultrastructure-Function Correlative Studies for Cardiac Cryopreservation. IV. Prethaw Ultra-

structure of Myocardium Cooled Slowly ($\leq 2°C$/min) or Rapidly ($\geq 70°C$/sec) with or without Dimethyl Sulfoxide (DMSO) 130

D. Siminovitch, J. Singh, and I. A. de la Roche. Studies on Membranes in Plant Cells Resistant to Extreme Freezing. I. Augmentation of Phospholipids and Membrane Substance without Changes in Unsaturation of Fatty Acids during Hardening of Black Locust Bark 144

Shosuke Kaku. Analysis of Freezing Temperature Distribution in Plants 154

J. O. Anderson and J. Nath. The Effects of Freeze-Preservation on Some Pollen Enzymes. 1. Freeze-Thaw Stresses 160

V. Damjanovic. Selective Thermal Effects on Freeze-Dried Biological Materials 169

Brief Communication

Robert P. Faraci, Demetrius H. Bagley, Jo Anne C. Marrone, and Robert M. Beazley. The Effect of Curative Cryosurgery on the Tumor-Specific Immune Response of C57 Mice 175

Number 3, June 1975

Fabian J. Lionetti, Stephen M. Hunt, Joel M. Gore, and William A. Curby. Cryopreservation of Human Granulocytes 181

G. J. Morris. Lipid Loss and Haemolysis by Thermal Shock: Lack of Correlation 192

D. Simatos, M. Faure, E. Bonjour, and M. Couach. The Physical State of Water at Low Temperatures in Plasma with Different Water Contents as Studied by Differential Thermal Analysis and Differential Scanning Calorimetry 202

Kimio Shimada and Éizo Asahina. Visualization of Intracellular Ice Crystals Formed in Very Rapidly Frozen Cells at $-27°C$ 209

Michael J. Varkarakis, Demetrios Papahadjopoulos, and Gerald P. Murphy. Renal Adenosine Triphosphatase in Hypothermically Stored Canine Kidneys 219

P. Skaaring, F. Bierring, J. Hejnal, V. Svendsen, E. Jensen, and E. Kemp. Ultrastructure of the Glomerular Filtration Membrane of Autotransplanted Canine Kidneys Stored for 24 Hours 224

J. Foreman. Prediction of Viability of Rabbit Kidneys Preserved by Hypothermic Perfusion 231

G. R. N. Jones. Metabolic Studies of Isolated Canine Hearts Perfused at 4°C for up to 96 Hours, with Assessment of Viability 238

J. S. Willis, R. F. Foster, and C. L. Behrends. Cold-Stored Kidney Tissue of Hibernators: Effects of Brief Warming on K Regulation 255

Michael S. Hudecki and C. A. Privitera. Lipid Changes in Tissues from the Cold-Exposed, Torpid and Aroused Pigmy Mouse, *Baiomys taylori* 266

Brief Communication

Ben Darbyshire. The Results of Freezing and Dehydration of Horseradish Peroxidase 276

Number 4, August 1975

FOREWORD 283
HAROLD T. MERYMAN. Basile J. Luyet: In Memoriam 285
G. RAPATZ, B. LUYET, AND A. MACKENZIE. Effect of Cooling and Rewarming Rates on Glycerolated Human Erythrocytes 293
DONALD B. PRIBOR. Biological Interactions Between Cell Membranes and Glycerol or DMSO 309
J. NATH, AND S. R. GONDA. Effects of Freezing and Thawing on Glycerol Mutants of *Escherichia coli* 321
D. H. RASMUSSEN, M. N. MACAULAY, AND A. P. MACKENZIE. Supercooling and Nucleation of Ice in Single Cells 328
EVA-MARIA AMRHEIN. Comparative Crystallization Behavior of Polymers and Aqueous Solutions 340
J. E. TANNER. Observations of Rapid Freezing of Salt Solutions 353
M. D. PERSIDSKY, AND B. J. LUYET. Analysis of the Freezing Process Across Temperature Gradients Within Gelatin Gels 364
VERNON P. PERRY, J. LAVERNE MARTIN, AND CALVIN A. KROENER. Nutrient Medium and Frozen Storage of Human Lymphocytes 386
CALVIN A. KROENER, VERNON P. PERRY, J. LAVERNE MARTIN, AND JOHN C. SASSO. Freeze Drying of Histocompatibility Typing Sera 397
LEO J. MENZ. Effect of Cryoprotective Agents on Rat Cutaneous Nerves. 405
K. C. GUPTA. The Mechanism of Cryohemolysis: By Direct Observation with the Cryomicroscope and the Electron Microscope 417
A. P. MACKENZIE, T. A. KUSTER, AND B. J. LUYET. Freeze-Fixation at High Subzero Temperatures 427
CURRICULUM VITAE AND LIST OF PUBLICATIONS OF B. J. LUYET 440

Number 5, October 1975

R. L. GROSS, A. G. LEVIN, F. G. PEERS, C. M. STEEL, AND T. TSU. Spontaneous Rosette and Rosette-Inhibition Tests on Fresh and Cyropreserved Lymphocytes 455
BRUCE HACKER, CLARE DOTY, AND BONNIE J. MCDERMOTT-SHEEDY. The Cyropreservation of Mouse Leukemic Cells. I. Effects on Drug Resistance and the Patterns of Nucleic Acid Metabolism 463
KENNETH R. DILLER. Intracellular Freezing: Effect of Extracellular Supercooling 480
H. LENZ, W. GOERTZ, AND H. PREUSSLER. The Freezing Threshold of the Peripheral Motor Nerve: An Electrophysiological and Light-Microscopical Study on the Sciatic Nerve of the Rabbit 486
M. HAIGHT, J. FRIM, J. PASTERNAK, AND H. FREY. Freeze–Thaw Survival of the Free-Living Nematode *Caenorhabditis briggsae* 497
IAN A. DE LA ROCHE, M. K. POMEROY, AND C. J. ANDREWS. Changes in Fatty Acid Composition in Wheat Cultivars of Contrasting Hardiness 506
L. WEATHERBEE, E. D. ALLEN, H. H. SPENCER, S. M. LINDENAUER, AND P. A. PERMOAD. Red Cells Preserved with 10% Hydroxyethyl Starch: Effect of Prefreeze Washing 513

Brief Communication

M. J. Ashwood-Smith and Patricia Lough. Cryoptotection of Mammalian Cells in Tissue Culture with Methanol 517

Number 6, December 1975

M. A. Facktor, D. M. Strong, J. L. Miller, and K. W. Sell. Cell-Mediated Lymphocytotoxicity Following *in Vitro* Sensitization of Frozen Stored Human Mononuclear Cells in Heterologous Serum 521

L. E. McGann, J. Kruuv, J. Frim, and H. E. Frey. Factors Affecting the Repair of Sublethal Freeze-Thaw Damage in Mammalian Cells. I. Suboptimal Temperature and Hypoxia 530

J. J. McGrath, E. G. Cravalho, and C. E. Huggins. An Experimental Comparison of Intracellular Ice Formation and Freeze-Thaw Survival of Hela S–3 Cells 540

Abstracts of Papers Presented at the 12th Annual Meeting of the Society for Cryobiology 551

Index of Authors of Abstracts 591

Author Index for Volume 12 594

Subject Index for Volume 12 596